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PERFORMANCE EVALUATION OF SHIPPING CONTAINERS, FOR THE GBU-15 G--ETC(U)
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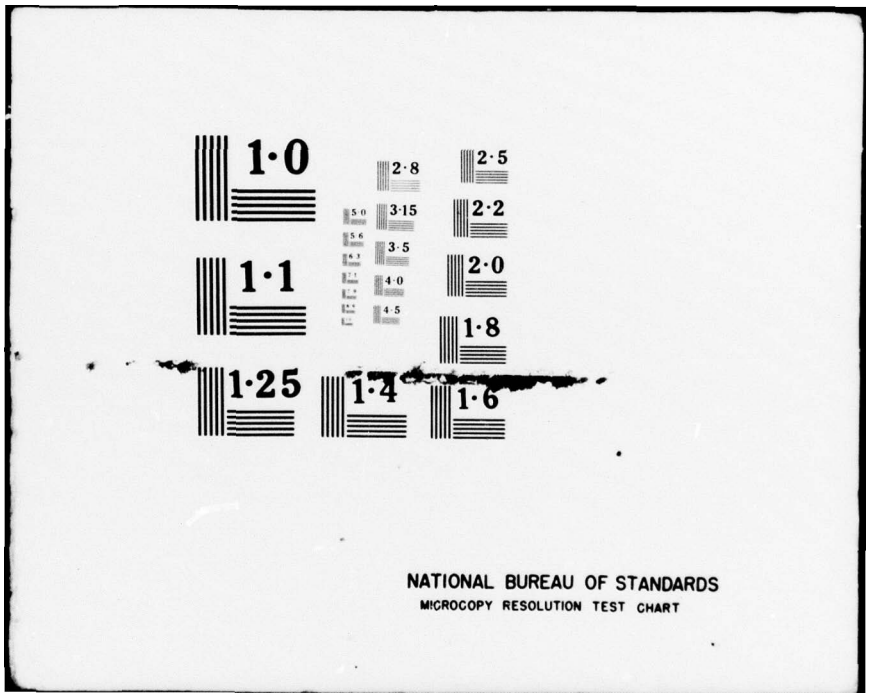
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PERFORMANCE EVALUATION OF SHIPPING CONTAINERS FOR THE GBU-15 GUIDED BOMB SYSTEM AND THE AIM 9J-1 CANARDS

HQ AFALD/PTP
AIR FORCE PACKAGING EVALUATION AGENCY
WRIGHT-PATTERSON AFB OH 45433

SEPTEMBER 1977

(See 1473)

NOTICE

ABSTRACT

Each of the four containers used for the GBU-15 TV guided bomb system were subjected to vibration and superimposed load tests to simulate conditions experienced during transport and storage respectively. In addition, the dynamic performance of the containers was evaluated using one or more mechanical or rough handling tests, including free-fall drop, edgewise rotational drop, and pendulum impact. The containers were checked for pressure retention before and after completion of the tests. All tests were conducted in conformance with Federal Test Method Standard 101B. Subsequent functional tests conducted on each GBU-15 item indicated they were fully operational.

Evaluation of the M548 ammunition can for the AIM 9J-1 canards was limited to vibration and free-fall drop tests. The canards were undamaged after test.

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INTRODUCTION

The Air Force Packaging Evaluation Agency (AFPEA) received five containers for testing and evaluation. The containers were:

a. WCU-3B Common Control Container

b. DSU-27/B Target Detecting Device Container

c. SBU-22/B Displacement Gyroscope Container

d. AN/DWW-1 Automatic Pilot Container

e. M548 Ammo Can Container for Fins (Canards) for AIM 9J-1

Representatives from ADTC, Eglin AFB FL were present for the entire test.

Items a through d are modules of the GBU-15 TV guided bomb system. These containers were tested as part of a qualification study and were obtained through the Container Design Retrieval System.

Item e is a container for the AIM 9J-1 canards.

Following are tests performed on containers indicated, in accordance with Federal Test Method Standard 101B using the methods indicated:

CONTAINER	TEST	FTMS METHOD	INSTRUMENTATION
WCU-3B	Leak Test	5009	Water Manometer
(Figure 1)	Vibration Test	5019	Accelerometers
	Edgewise Drop	5008	Accelerometers
	Pendulum Impact	5012	Accelerometers
	Superimposed Load	5016	N/A
	Leak Test	5009	Water Manometer
DSU-27/B	Leak Test	5009	Water Manometer
(Figure 2)	Vibration Test	5019	Accelerometers
	Superimposed Load	5016	N/A
	Free-Fall Drop	5007	Accelerometers
	Leak Test	5009	Water Manometer
SBU-22/B	Leak Test	5009	Water Manometer
(Figure 3)	Superimposed Load	5016	N/A
	Vibration	5019	Accelerometers
	Free-Fall Drop	5007	Accelerometers
	Leak Test	5009	Water Manometer

CONTAINER	TEST	FTMS METHOD	INSTRUMENTATION
AN-DWW-1	Leak Test	5009	Water Manometer
(Figure 4)	Superimposed Load	5016	N/A
	Vibration Test	5019	Accelerometers
	Free-Fall Drop	5007	Accelerometers
	Leak Test	5009	Water Manometer
M548	Vibration Test	5019	N/A
(Figure 5)	Free-Fall Drop	5007	N/A

INSTRUMENTATION

Three Endevco, Model 2233D, piezoelectric accelerometers were used to instrument the drop tests, pendulum impact, and vibration tests. The accelerometers were used to measure the shock input to the various containers along the three main axes and were mounted on the center of gravity of the test items.

Conditioning of the accelerometer output was accomplished by Endevco, Model 2641C, charge amplifiers powered by Endevco, Model 2622C, power supplies. The continuous output was displayed on a Tektronix, Model 564B, storage oscilloscope, equipped with a Tektronix still camera, Model C-12.

During leak tests, a MERIAM, Model RC-4615, water manometer was used. This instrument is graduated in 0.20 inch increments.

The vibration test was performed on a L.A.B. Corporation vibration machine, serial 56801, type 5000-96B, which has a frequency servoloop constant displacement cam linked motor drive. The L.A.B. Corporation vibration machine's maximum load capacity is 5000 pounds vibrated at 3G peak sinusoidal acceleration or 1.0 inch double amplitude displacement from 0 to 40 Hz. A 144" x 96" x 1.5" plywood deck was mounted on the 96" x 98" vibration machine table. Excessive horizontal container motion was limited by barricades nailed to the plywood deck 1/2 inch from the container centered on the vibration machine table. Instrumentation consisted of a tachometer and cam displacement indicator integral to the L.A.B. Corporation vibration machine.

DESCRIPTION OF TESTS AND RESULTS

A. WCU-3B Container (Figure 1)

1. LEAK TEST: The manometer previously described was connected to the sealed container. An air supply was connected to a filler valve and the container filled with air to approximately 1.5 psi. The procedure in FTMS 101B, Method 5009, was followed without exception.

The results of the test are tabulated below:

TEST (SECONDS)	INCHES H_2O DISPLACEMENT
00	20.76
420	20.51
660	20.41
1020	20.30
1320	19.41
1800	19.30

2. VIBRATION TEST: The container, provided by ADTC Eglin AFB FL, with the WCU-3B Module inside, was subjected to Federal Test Method Standard 101, Method 5019 Vibration (Repetitive Shock) Test without exception, using the option which specifies maximum platform acceleration to be 1.0 $\pm$ 0.1 times the acceleration of gravity. During test, the container lifted from the platform repeatedly and a 1/16 inch thick feeler gauge was used to establish vibration table input by increasing the drive frequency until the 1/16 inch feeler gauge would pass freely under the container during the bounce portion of the vibration cycle. The table drive frequency maintained for the two hour test period was 4.4 Hz with table peak acceleration being 0.99G and table double amplitude displacement being 1.0 inch.

Results: The WCU-3B received a 0.5G peak-to-peak, maximum acceleration during this test.

3. EDGEWISE DROP TEST: The container was placed on its bottom with one end of the base supported on a sill nominally 6" high. The unsupported end of the container was raised to a height of 16" and released for impact. This test was applied to two points 180" apart.

Results: Peak accelerometer reading of 12G was recorded.

4. PENDULUM IMPACT: The container was placed on the platform with the impact end extending over the edge of the platform just enough to make contact with the concrete bumper. The platform was then pulled back so that the center of gravity of the container was raised 9".

Upon release, the platform then swung to impact the concrete bumper with an impact velocity of 7 fps. This procedure was followed for testing both ends and two opposite sides of the container.

Results: Peak G and Duration

TOP END	Approximately 10G with 20 ms duration
BOTTOM END	Approximately 14G with 20 ms duration
SIDES	Approximately 16G with 30 ms duration

5. SUPERIMPOSED LOAD TEST: The container was placed on a TMI, Model 17-24, compression tester. A force of 1730 pounds was applied to the container for 1 hour.

Results: No visible damage, container deflected 0.11 inches.

6. LEAK TEST: (After completion of all other testing) Identical to test described in section A.1.

Results: No loss of pressure.

CONCLUSION

Post test functional check indicated the WCU-3B Module to be fully operational.

B. DSU-27/B Target Detecting Device Container (Figure 2)

1. LEAK TEST: Identical to test described in section A.1.

Results: No loss of pressure.

2. VIBRATION TEST: Identical to test described in section A.2.

Results: The DSU-27/B received 0.5G peak-to-peak, maximum acceleration during this test.

3. SUPERIMPOSED LOAD TEST: Identical to test described in section A.5.

Results: No visible damage, container deflected 0.11 inches.

4. FREE-FALL DROP TEST: The container, with item, was raised 18" and released onto a rigid concrete floor. The test was conducted 6 times.

Results:

DROP ORDER	ORIENTATION	ACCELERATION X	Y	Z	RESULTANT G	AVERAGE DURATION
1	Bottom Flat				No Data	
2	Top Flat	6	4	16	18	20 ms
3	Top Edge	4	8	14	17	36 ms
4	Bottom Edge	9	8	12	17	35 ms
5	Bottom Edge	14	5	11	18	35 ms
6	Top Edge	8	4	15	17	40 ms

5. LEAK TEST: Identical to test described in section A.1.

Results: No loss of pressure.

CONCLUSION

Post test functional checks indicated the DSU-27/B Target Detecting Device to be fully operational.

C. SBU-22/B Displacement Gyroscope Container (Figure 3)

1. LEAK TEST: Identical to test described in section A.1.

Results: Large leak was located on the drum seam and the test was terminated.

2. SUPERIMPOSED LOAD TEST: Identical to test described in section A.5. except 370 pounds were exerted on the item.

Results: No damage and 0.07" deflection.

3. VIBRATION TEST: Identical to test described in section A.2.

Results: The gyroscope received a 1G peak-to-peak, maximum acceleration.

4. FREE-FALL DROP TEST: Test conducted on a Gaines Engineering Company drop table, serial number 4693. The table was raised to 30" and the container impacted on a steel plate a total of six times.

Results:

DROP ORDER	ORIENTATION	ACCELERATION X	Y	Z	RESULTANT G	AVERAGE DURATION
1	Bottom Flat	0	0	30	30	80 ms
2	Top Flat	0	10	15	18	40 ms
3	Bottom Edge	0	10	12	15	60 ms
4	Top Edge	Unreadable				
5	Bottom Edge	Unreadable				
6	Top Edge	0	0	10	10	20 ms

5. LEAK TEST: Test was not conducted because of previous failure.

CONCLUSION

Post test functional checks indicated the SBU-22/B Gyroscope to be fully operational.

D. AN/DWW-1 Automatic Pilot Container (Figure 4)

1. LEAK TEST: Identical to test described in section A.1.

Results:

TEST (SECONDS)	INCHES H_2O DISPLACEMENT
00	20.76
900	20.56
1800	20.46

2. SUPERIMPOSED LOAD TEST: Identical to test described in section A.5.

Results: No damage.

3. VIBRATION TEST: Identical to test described in section A.2.

Results: The Autopilot received a maximum of 2G during this test.

4. FREE-FALL DROP TEST: Test conducted on a Gaines Engineering Company, Serial 4693, drop table. The table was raised to 30" and the container dropped six times onto a steel plate.

Results:

DROP ORDER	ORIENTATION	ACCELERATION X	Y	Z	RESULTANT G	AVERAGE DURATION
1	Bottom Flat	8	2	20	22	45 ms
2	Top Flat	Instrumentation Failed				
3	Bottom Edge	Unreadable Trace				
4	Top Edge	Unreadable Trace				
5	Bottom Edge	12	8	15	21	20 ms
6	Top Edge	Instrumentation Failed				

NOTE: During testing the accelerometers came off of the Autopilot and were relocated for test 5 and 6.

5. LEAK TEST: Identical to test described in section A.1.

Results:

TIME (SECONDS)	PRESSURE (INCHES)
00	20.76
1800	20.26

CONCLUSION

Post test functional check indicated the AN/DWW-1 Automatic Pilot to be fully operational.

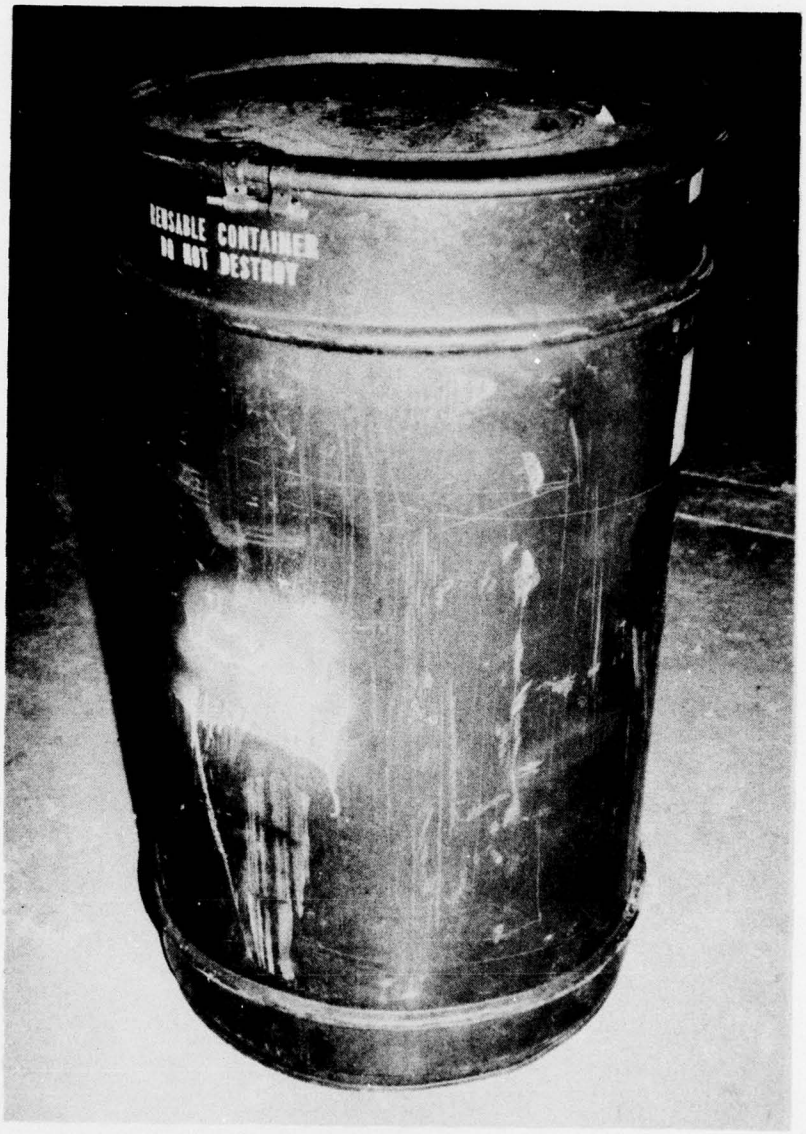
E. M548 Ammunition Can Containing AIM 9J-1 Canards (Figure 5)

1. VIBRATION TEST: Identical to test described in section A.2, except no instrumentation was used and the container was vibrated for three hours instead of two.

Results: No damage.

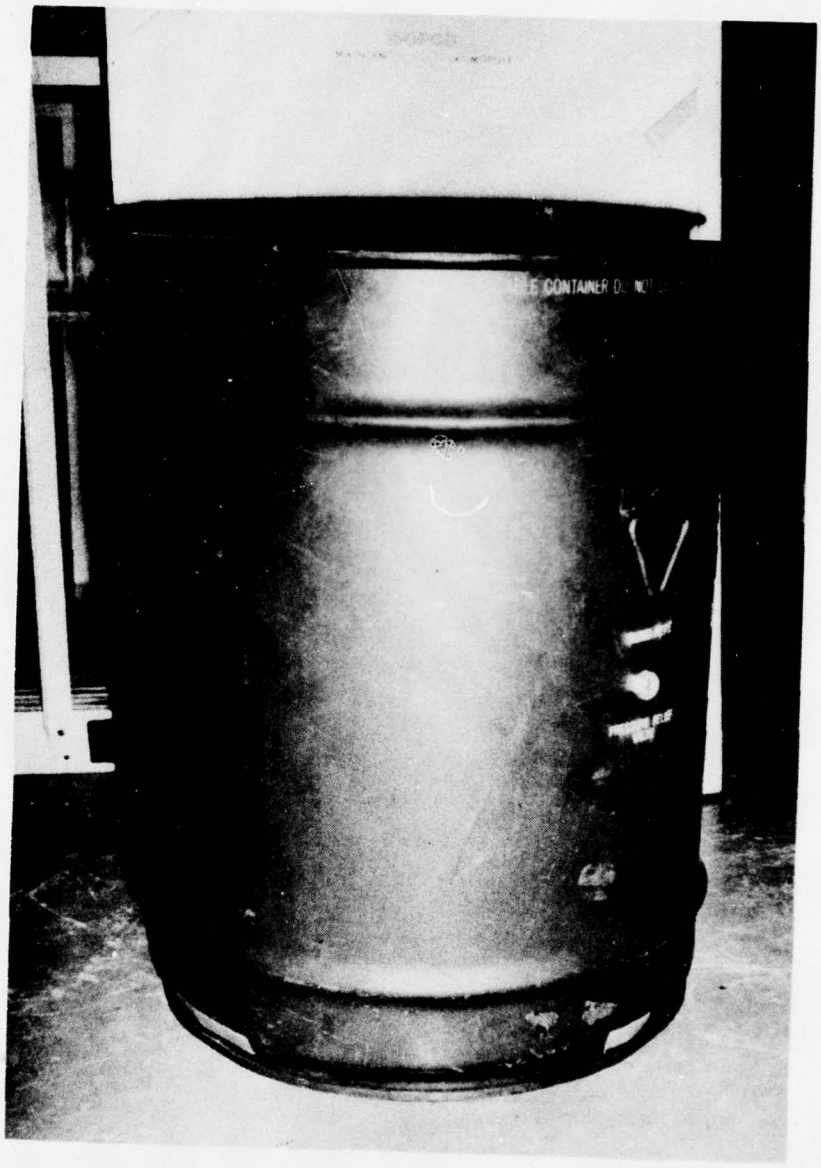
2. FREE-FALL DROP TEST: The container was dropped on all six flat sides from a 30" Gaines drop table.

Results: No damage.



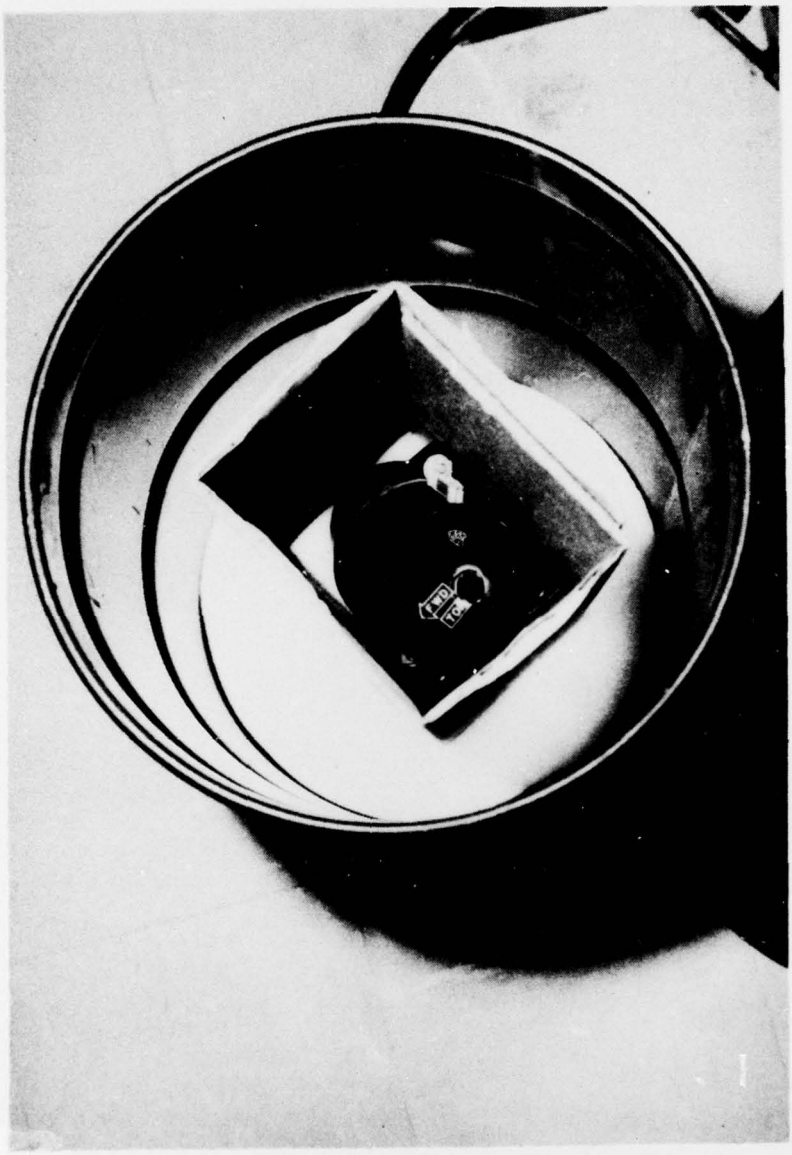
WCU-38 COMMON CONTROL CONTAINER (POST TEST)

FIGURE 1



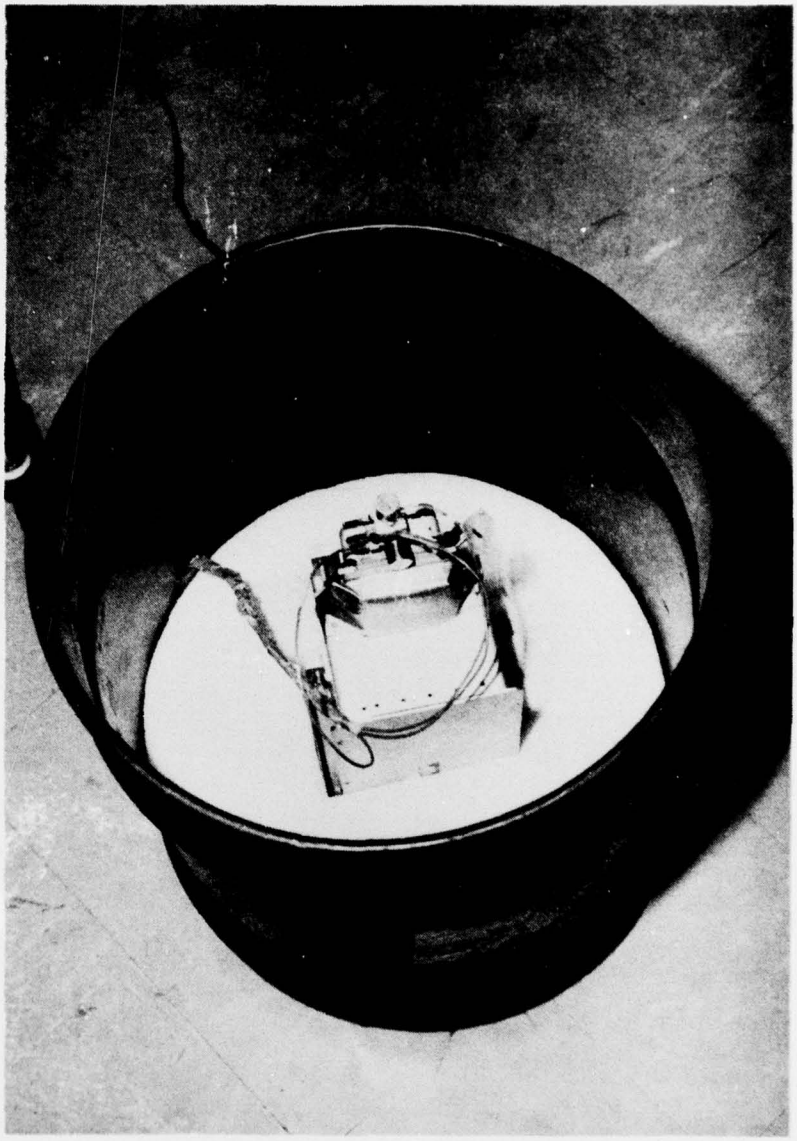
DSU-27/B TARGET DETECTING DEVICE CONTAINER

FIGURE 2



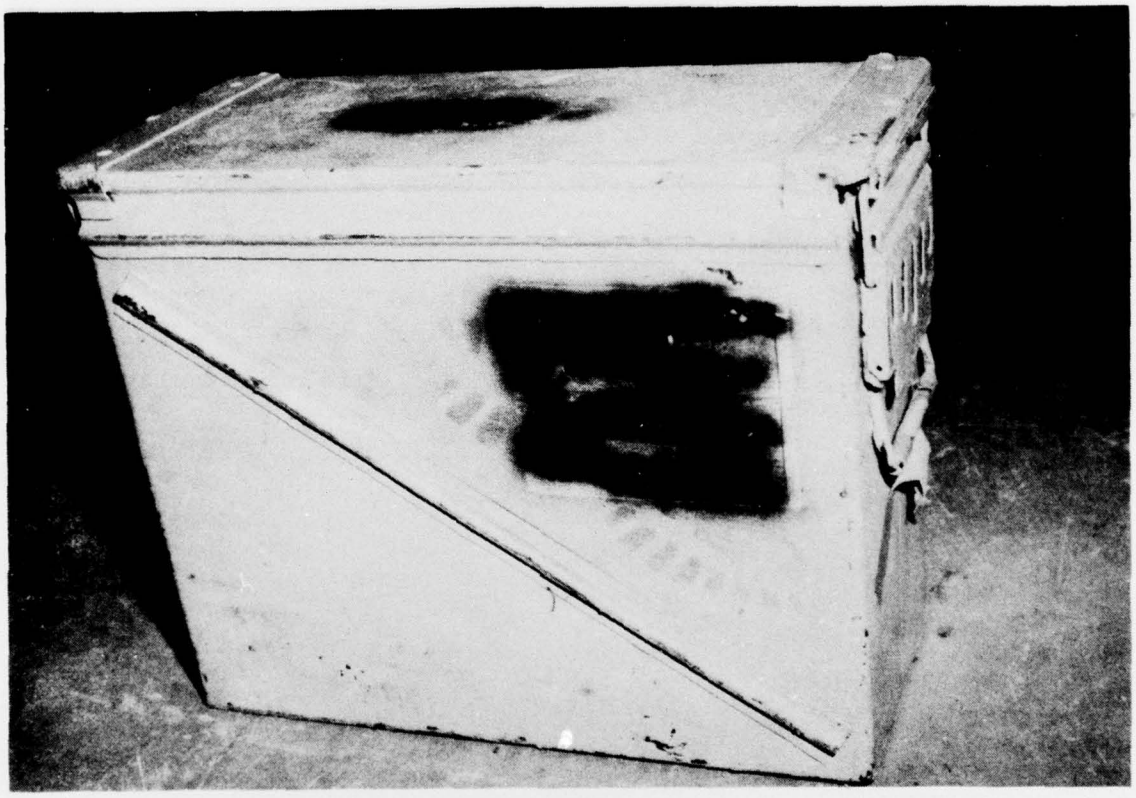
SBU-22/B GYROSCOPE DISPLACEMENT CONTAINER

FIGURE 3



AN/DWW-1 AUTOMATIC PILOT CONTAINER ACCELERATION LOCATION FOR DROPS 1-4

FIGURE 4



M548 AMMO CONTAINER FOR FINS (CANARDS) FOR AIM 9J-1

FIGURE 5

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Evaluation of the M548 ammunition can for the AIM 9J-1 canards was limited to vibration and free-fall drop tests. The canards were undamaged after test.